ORBIT OF THE SPECTROSCOPIC BINARY BOSS 3511

BY W. E. HARPER, M.A.

This star ($\alpha = 13^h\ 30^m$, $\delta = 37°\ 42'$) was announced a spectroscopic binary by Wright and Allen in *Lick Observatory Bulletin*, No. 173, from four plates which showed a range of about 12 km. For a single-prism instrument, this range is rather small for successful work on the star but in this case the small variation in velocity is offset by an excellent F-type spectrum, the lines of which can be very accurately measured. For this reason it was placed on the programme. The star's photographic magnitude is 5·3. Thirty-two plates were secured in 1917 and six in 1918, and upon these the orbit is based. A preliminary value of the period was arrived at from a comparison of the 1917 observations with the early Lick observations. There was some uncertainty in the exact number of cycles elapsing between the two sets of observations, and the period, accepted as best at that time, required a small correction in order to suit the 1918 observations. While the period of 1·61100 days here determined suits our own observations and the 1908 and 1909 observations of the Lick Observatory, it fails to suit their 1905 observation, so that even yet some uncertainty exists though this value seems to be the only possible one from the observations.

About 15 or 20 lines were measured on each plate. Their wave-lengths are given in the following table, which shows how often they were measured, with the residuals, numerical and algebraic. These are taken in the sense, mean of plate minus line velocity. There are a few whose values should in future be adjusted but such has not been done in the case of this star.

LINES USED IN BOSS 3511

λ	n	Residual Numerical	Residual Algebraic	λ	n	Residual Numerical	Residual Algebraic
4584·018	14	11·2	+ 4·2	4290·053	13	6·7	+ 2·6
4572·190	28	9·2	+ 6·1	4271·675	38	4·0	+ 0·2
4549·743	38	5·1	+ 0·2	4260·537	25	3·6	+ 1·3
4534·158	12	7·3	− 0·2	4250·586	18	3·5	− 2·6
4501·417	18	9·9	− 6·0	4236·000	16	6·5	+ 0·2
4481·477	30	10·4	− 8·0	4233·425	30	6·8	− 4·7
4468·663	7	6·4	− 2·3	4227·107	5	7·4	+ 2·7
4415·345	33	5·0	− 1·9	4215·733	26	4·1	− 0·8
4404·861	22	5·5	− 2·1	4202·366	16	12·0	+11·5
4395·155	5	20·0	−17·5	4198·677	9	5·7	− 3·2
4351·977	17	9·5	− 1·4	4143·839	28	5·7	+ 1·0
4340·645	29	6·6	− 1·7	4071·865	14	4·0	+ 2·8
'325·698	25	6·2	+ 2·8	4063·730	23	5·7	+ 3·0
307·974	29	5·1	− 0·9	4045·940	34	3·4	+ 1·4
294·359	14	8·0	+ 5·4				

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SUMMARY OF MEASURES OF BOSS 3511

Plate	Date			Julian Date	Phase	Velocity	O–C
		1905					
Mt. Wilson	June	20		2,417,017·738	1·329	+ 7·43	+ 8·0
		1908					
"	Jan.	7		7,948·049	0·482	+ 9·90	− 3·3
		1909					
"	April	17		8,414·913	0·156	+ 2·06	+ 1·3
"	"	19		8,416·867	0·499	+13·74	− 0·1
		1917					
8049	Feb.	11		2,421,271·906	0·846	+14·0	− 1·0
8055	"	12		272·860	0·189	+16·7	+14·9
8065	"	18		278·747	1·243	− 1·5	− 4·0
8080	"	27		287·940	0·770	+17·7	+ 2·0
8087	Mar.	1		289·869	1·088	+ 5·2	− 3·0
8095	"	2		290·879	0·487	+16·7	+ 3·7
8134	"	30		318·785	1·006	+ 0·9	−10·2
8140	April	8		327·710	0·265	+ 4·0	− 1·0
8144	"	10		329·784	0·728	+16·4	+ 0·2
8148	"	16		335·809	0·309	− 4·1	−10·9
8149	"	18		337·706	0·595	+12·9	− 2·4
8151	"	21		340·716	0·383	+ 9·0	− 0·6
8154	"	22		341·784	1·451	− 6·5	− 3·2
8160	"	24		343·731	0·176	− 1·0	− 2·3
8162	May	3		352·747	1·137	+ 6·8	+ 0·4
8165	"	13		362·656	1·380	− 7·1	− 5·1
8176	"	20		369·755	0·424	+13·4	+ 2·2
8185	"	29		378·758	1·372	+ 2·8	+ 4·6
8186	"	30		379·616	0·619	+17·2	+ 1·6
8190	June	3		383·736	1·517	− 2·8	+ 0·9
8191	"	5		385·582	0·141	0·0	− 0·1
8197	"	16		396·678	1·571	− 4·1	− 0·4
8200	"	18		398·598	0·269	+ 8·4	+ 3·2
8209	"	27		407·617	1·233	+12·3	+ 9·5
8213	July	2		412·598	1·391	+ 5·9	+ 7·8
8220	"	6		416·619	0·569	+15·7	+ 1·0
8226	"	16		426·608	0·892	+17·6	+ 3·5
8241	"	25		435·582	0·200	+ 4·8	+ 2·4
8244	"	27		437·588	0·593	+15·6	+ 0·3
8253	Aug.	2		443·625	0·188	− 0·9	− 2·7
8259	"	6		447·570	0·911	+13·5	− 0·2
8263	"	10		451·577	0·085	− 0·4	+ 1·2
		1918					
8448	Feb.	17		642·777	1·187	+ 4·7	+ 0·2
8462	"	26		651·790	0·534	+ 9·3	− 4·8
8467	Mar.	8		661·677	0·755	+14·1	− 2·0
8479	"	22		675·664	0·243	+ 4·3	+ 0·2
8486	April	2		686·633	1·545	− 3·4	+ 0·4
8493	"	4		2,421,688·701	0·392	+ 7·1	− 2·9

MEASURES OF BOSS 3511

λ	8049 Vel.	Wt.	8055 Vel.	Wt.	8065 Vel.	Wt.	8080 Vel.	Wt.	8087 Vel.	Wt.	8095 Vel.	Wt.	8134 Vel.	Wt.
4584	0·0	¼			− 9·0	1								
4572	− 8·0	¼	+13·3	1	−15·7	½								
4549	− 4·0	¾	+ 2·2	1	−13·1	1	+ 5·0	1	+ 4·4	1	+19·1	1	+ 6·6	1
4534	+ 7·4	½	+ 3·9	½	−10·9	1	+ 3·0	½						
4528					−13·0	1								
4501					−11·4	½	+ 5·6	½	+12·6	½			+ 8·4	½
4481	− 7·8	¼	− 2·7	1	+ 7·8	½	+23·1	½	− 5·5	½			+25·5	½
4468	+ 2·6	½												
4415	+16·2	½	+17·2	1	−11·8	1	+ 9·6	1	+ 4·8	1			+ 0·8	½
4404			+ 3·2	1	−18·4	1	+16·4	1	+ 4·7	1			−12·0	½
4383	− 0·7	¼	− 6·0	1										
4351					−24·1	1	+16·7	½					+11·0	1
4340			− 0·8	½	−18·5	½	+10·8	1	+ 4·5	1			+ 3·3	½
4325			+ 3·7	½	−25·9	1	+ 5·8	1	+ 2·2	1	6·8	½		
4307	+ 4·7	¼	+ 6·9	1	−11·9	½	+16·0	1	− 1·3	1	1·2	¼	+ 3·2	1
4290			−12·6	1	−22·0	1	+24·8	1	−11·3	1			− 4·2	½
4271	−18·9	¼	+ 0·5	1	−19·4	1	+ 7·4	1	− 9·2	1	7·7	1	+ 7·4	1
4260							+ 7·6	1	− 9·6	1	2·4	1	− 5·6	1
4250					−13·6	1			− 4·7	1			+12·1	1
4236					−25·4	1			− 3·4	1				
4233	+ 6·2	½	+ 8·5	1	0·0	1	+12·9	1	+ 1·5	1	+17·8	1	− 2·1	1
4227					− 6·3	1	+ 1·0	1						
4215	−15·0	¼	− 1·7	1	−15·0	½	+12·0	1	− 0·6	1			+ 2·6	½
4202					−24·0	1	0·0	1	−12·7	1			−17·0	1
4198					+ 6·0	½			− 1·0	1				
4143	0·0	¾	+ 8·0	1	− 8·9	1	+ 2·5	1	− 8·8	1				
4101					−12·3	½								
4077							+ 5·2	1	− 6·0	1				
4071	− 8·6	¼	− 3·4	1			+10·0	1	− 6·1	1				
4063					− 6·8	1	+ 6·3	1	− 6·7	1			− 4·5	½
4045	+ 9·2	¾	+ 7·2	1	−13·0	1	+11·9	1	− 4·9	1			− 5·3	½
4005							0·0	1						
Weighted mean	± 0·00		+ 2·84		−13·68		+ 9·01		− 2·90		+ 8·80		+ 1·75	
V_a	+14·35		+14·07		+12·25		+ 9·16		+ 8·48		+ 8·14		− 2·24	
V_d	− ·03		+ ·03		+ ·17		− ·15		− ·07		+ ·09		− ·06	
Curv.	− ·28		− ·28		− ·28		− ·28		− ·28		− ·28		− ·28	
Radial Velocity	+14·0		+16·7		− 1·5		+17·7		+ 5·2		+16·7		− 0·8	

MEASURES OF BOSS 3511—*Continued*

λ	8134 Vel.	Wt.	8140 Vel.	Wt.	8144 Vel.	Wt.	8148 Vel.	Wt.	8148 Vel.	Wt.	8149 Vel.	Wt.	8151 Vel.	Wt.
4584	....	....	....	....	....	....	+11·6	½	+ 0·7	1	+ 0·3	½	....	....
4572	....	....	....	....	+14·1	½	....	....	−13·3	¼	+ 7·0	½	+ 3·6	¼
4549	+10·0	1	+ 9·5	½	13·5	1	− 6·0	1	− 3·9	1	+17·1	½	+ 3·0	¼
4501	....	....	....	....	....	....	+22·1	1	+28·4	½	+19·0	½	+45·7	½
4481	+14·2	½	− 2·0	½	37·6	½	+15·0	¾	+17·5	¾	+22·6	½	+44·6	½
4468	....	....	....	....	25·8	½	− 4·7	¾	....	....	....	....	....	....
4415	+ 2·4	1	+10·0	1	21·0	¾	+ 1·9	1	+ 6·0	1	+21·0	1	....	....
4404	....	....	....	....	20·6	¾	....	....	+ 6·8	1	+15·2	½	+23·2	¼
4395	....	....	....	....	16·5	½	....	....	....	....	....	....	....	....
4351	....	....	....	....	47·4	½	....	....	....	....	+23·5	½	....	....
4340	+ 0·3	½	+ 8·6	½	29·0	½	+13·1	1	+13·9	1	....	....	+32·3	¼
4325	....	....	− 4·0	¾	....	....	....	....	....	....	+14·9	1	....	....
4307	+ 6·9	1	+21·2	¾	18·1	½	− 1·4	1	+ 4·2	1	....	....	+ 4·8	¼
4290	....	....	....	....	26·6	¾	− 3·1	1	−12·3	1	....	....	....	....
4271	+10·3	1	+ 9·6	¾	26·2	¾	+ 5·6	¾	+ 8·8	1	+20·3	1	− 1·0	¼
4260	− 2·1	1	+ 9·0	¾	19·2	1	....	....	....	....	+23·1	1	....	....
4250	+ 6·4	½	....	....	29·6	¾	+11·6	½	....	....	+28·6	½	....	....
4236	....	....	....	....	....	....	+ 3·0	½	....	....	+29·5	1	....	....
4233	+ 0·2	1	....	....	40·9	¾	+ 4·6	1	− 0·2	1	+26·5	½	+10·4	¼
4227	....	....	....	....	....	....	....	....	....	....	+25·2	½	....	....
4215	+11·3	1	+18·3	½	....	....	+ 4·5	1	− 1·1	1	....	....	....	....
4202	−20·3	1	....	....	15·2	1	−12·2	1	−13·6	1	....	....	....	....
4198	....	....	....	....	....	....	+ 9·6	1	....	....	....	....	....	....
4143	+ 7·0	½	+11·9	½	15·1	1	+ 4·6	1	+ 4·4	1	+33·2	1	....	....
4063	+16·4	½	+13·6	½	18·1	1	+ 9·2	1	+17·6	1	....	....	....	....
4045	− 5·6	½	+13·7	½	23·8	1	+ 4·2	1	+10·7	1	....	....	....	....
Weighted mean	+ 3·45		+ 9·79		+ 23·00		+ 5·28		+ 4·14		+ 22·22		+ 19·00	
V_a	− 2·24		− 5·52		− 6·27		− 8·36		− 8·36		− 9·01		− 9·99	
V_d	− ·06		− ·02		− ·12		− ·19		− ·19		− ·07		− ·03	
Curv.	− ·28		− ·28		− ·28		− ·28		− ·28		− ·28		− ·28	
Radial Velocity	+ 0·9		+ 4·0		+ 16·3		− 3·5		− 4·7		+ 12·9		+ 8·7	

MEASURES OF BOSS 3511—*Continued*

λ	8154 Vel.	Wt.	8160 Vel.	Wt.	8162 Vel.	Wt.	8165 Vel.	Wt.	8176 Vel.	Wt.	8185 Vel.	Wt.	8186 Vel.	Wt.
4584	+ 5·2	1	......		......		......		0·0	½	+14·7	½	+34·0	½
4572	......		+ 9·0	1	+ 6·7	1	− 2·7	½	......		12·3	½	35·4	½
4549	......		+18·0	1	+20·6	1	+ 8·9	1	+27·5	½	33·6	1	27·2	½
4534	− 5·1	1	+13·0	1	......		......		......		......		......	
4522											25·7	½		
4481	+20·2	1	+30·0	1	......		+13·0	1	46·0	½	26·6	½	44·8	½
4468	+ 8·1	½											55·8	½
4415	+ 7·0	1	+ 3·2	1	+20·2	1	+ 7·3	1	25·0	½	27·5	1	26·3	1
4404									36·7	½	27·2	½	......	
4395	+42·3	½												
4351	+13·2	1	......		+37·6	1								
4340	+11·3	1	+16·1	1	......		+ 5·7	½	32·4	½				
4325	− 1·9	1	+ 3·8	1	+28·3	1	+11·5	½	37·0	½	17·8	½		
4307	+ 6·5	1			+25·8	1	+12·6	1	29·2	½	21·3	½		
4290	− 3·7	1	+ 9·8	1										
4282	......		+ 6·2	1	......		+21·9	1	62·0	½				
4271	+ 1·7	1	+14·5	1	+24·5	1	+10·2	1	38·6	½	21·5	1	30·0	½
4260			+ 6·2	1										
4250	+ 4·7	1	+12·4	1	+22·9	1	+14·2	1	31·3	½	......		41·8	½
4236	......		+ 1·4	1	+12·3	1								
4233	+ 7·3	1			+29·6	1	+11·6	1	30·7	½	24·4	1		
4227			− 2·6	1										
4215	+ 5·1	1	+12·7	1	+25·0	1	+13·1	1	31·1	1	30·0	1	46·6	1
4202	−21·8	1	− 7·8	1	+16·8	1	− 2·6	1	......				30·7	1
4198	......		+19·7	1	......				24·7	½	......		35·1	½
4143	+ 4·2	1	+14·5	1	+17·4	1	+ 4·0	1	34·8	1	9·1	1	......	
4071	......				+24·0	1	+ 8·0	1	26·4	1				
4063	− 4·6	1	+13·6	1	+ 9·4	1	+ 6·0	1	26·7	½	22·8	½	47·8	½
4045	+ 1·5	1	+11·2	1	+14·1	1	+10·8	1	+32·6	1	+15·4	½	+34·9	½
Weighted mean	+ 4·22		+ 10·28		+ 20·95		+ 9·50		+ 31·68		+ 22·65		+ 37·11	
V$_a$	− 10·32		− 10·96		− 13·66		− 16·23		− 17·79		− 19·39		− 19·52	
V$_d$	− ·14		− ·08		− ·16		− ·03		− ·19		− ·21		− ·06	
Curv.	− ·28		− ·28		− ·28		− ·28		− ·28		− ·28		− ·28	
Radial Velocity	− 6·5		− 1·0		+ 6·8		− 7·0		+ 13·4		+ 2·8		+ 17·2	

MEASURES OF BOSS 3511—*Continued*

λ	8190 Vel.	Wt.	8191 Vel.	Wt.	8197 Vel.	Wt.	8200 Vel.	Wt.	8209 Vel.	Wt.	8213 Vel.	Wt.	8220 Vel.	Wt.
4572	+ 6·6	1	....	....	+23·5	¾	....	....	+27·5	¾	+24·9	½	+28·2	½
4549	13·7	1	+13·5	½	22·6	¾	+38·3	¾	37·0	1	16·5	½	32·1	¾
4534	....	....	....	....	....	....	....	....	....	....	....	....	29·1	½
4501	27·4	1	....	....	....	....	....	....	46·7	¾	11·9	½	36·6	½
4481	....	....	....	....	40·5	½	22·2	½	30·3	¾	....	....	57·3	¾
4415	....	....	....	....	12·1	1	32·1	1	42·0	1	29·8	1	33·0	1
4404	28·4	1	23·2	½	....	....	....	....	....	....	32·6	1	....	....
4351	....	....	....	....	....	....	....	....	25·3	½	....	....	22·7	1
4340	9·8	1	....	....	19·3	¾	50·3	½	38·9	½	19·7	½	43·5	¾
4325	....	....	28·2	½	....	....	....	....	28·9	1	29·7	½	....	....
4307	20·2	1	15·7	½	17·7	1	....	....	30·5	½	32·2	½	37·3	1
4294	....	....	....	....	22·2	½	18·9	1	....	....	....	....	....	....
4290	....	....	....	....	19·2	1	....	....	26·6	1	....	....	....	....
4271	16·2	1	34·7	½	16·0	1	26·7	1	36·4	¾	28·9	½	35·7	1
4260	20·3	1	26·0	½	19·2	1	30·6	1	54·7	½	26·1	1	....	....
4250	....	....	....	....	20·8	1	....	....	....	....	....	....	38·3	1
4236	....	....	....	....	4·9	1	38·2	½	38·3	1	....	....	....	....
4233	24·6	1	26·5	½	17·2	1	34·0	¾	38·2	1	44·1	1	54·1	1
4227	....	....	....	....	....	....	31·3	½	....	....	....	....	....	....
4215	....	....	....	....	16·8	½	37·9	½	38·3	½	27·2	1	45·9	½
4202	....	....	....	....	6·0	½	....	....	....	....	....	....	27·7	¾
4198	....	....	....	....	11·8	¾	....	....	....	....	....	....	39·9	1
4143	....	....	6·0	½	17·8	½	13·2	½	28·3	½	18·2	1	40·4	1
4071	....	....	13·7	½	18·0	½	....	....	36·2	½	....	....	27·3	1
4063	13·1	1	+18·8	½	....	....	16·7	½	27·0	½	....	....	41·7	½
4045	+15·6	1	....	....	+16·8	½	+33·7	1	36·8	½	+30·5	1	+35·9	1
4005	....	....	....	....	....	....	....	....	+30·4	½	....	....	....	....
Weighted mean	+ 17·81		+ 20·63		+ 17·50		+ 30·10		+ 34·14		+ 27·60		+ 37·17	
V_a	− 20·09		− 20·31		− 21·22		− 21·30		− 21·39		− 21·23		− 20·99	
V_d	− ·21		− ·03		− ·19		− ·10		− ·16		− ·15		− ·21	
Curv.	− ·28		− ·28		− ·28		− ·28		− ·28		− ·28		− ·28	
Radial Velocity	− 2·8		± 0·0		− 4·1		+ 8·4		+ 12·3		+ 5·9		+ 15·7	

MEASURES OF BOSS 3511—*Continued*

λ	8226 Vel.	Wt.	8241 Vel.	Wt.	8244 Vel.	Wt.	8253 Vel.	Wt.	8259 Vel.	Wt.	8263 Vel.	Wt.	8448 Vel.	Wt.
4584							+21·0	1	+38·7	½			−20·5	½
4572	+22·9	½			+30·8	½	21·0	1	13·3	½	+10·6	1	−15·4	½
4549	32·3	½	+ 2·9	½	28·2	½	24·1	1	32·0	1	13·5	1	− 1·6	1
4534	53·8	½	15·7	½			25·0	1			22·0	1	−26·2	½
4522													− 1·9	½
4501			31·3	½					47·5	½			+ 1·3	1
4481	45·4	½			48·0	½	21·8	1	34·2	½	10·9	1		
4468					39·3	½								
4415	41·2	1			42·0	½			30·6	½	15·7	1	− 6·6	1
4404			38·0	½			27·9	1	28·4	½	17·2	1		
4395									51·3	½				
4351	38·7	½			38·7	½			31·5	½	16·1	1	−25·8	½
4340	58·7	½			48·7	½	4·2	1	26·0	½	6·2	1	+ 5·5	½
4325	45·8	½	49·3	½	18·5	½	9·6	1	27·4	½				
4307					23·7	½			41·6	½	19·5	1	− 2·8	½
4294	32·6	½			22·4	½					7·0	1	− 7·4	1
4290	28·8	½	24·5	½							12·5	1	−11·8	½
4271	47·8	½	14·9	½	37·8	½	19·4	1	27·4	½	3·4	1	− 3·9	½
4260	29·0	½	29·0	½	35·4	½	20·3	1	27·7	½	4·3	1	−10·6	½
4250			14·8	½							16·6	1		
4236											24·4	1	− 0·6	1
4233	40·8	½			34·2	½			19·5	½	24·6	1	− 4·8	1
4215	30·3	½					7·3	1	22·4	½			− 5·2	1
4202	15·8	½												
4198					37·8	½								
4143			18·3	½	36·8	½			42·0	½	18·0	1	−11·9	1
4077							12·8	1						
4071													− 8·0	1
4063					28·0	½	8·2	1						
4045	+41·4	½			+32·7	½	+ 9·6	1	+28·2	½	+17·0	1	− 5·6	1
Weighted mean	+ 38·03		+ 23·87		+ 34·27		+ 16·60		+ 30·09		+ 14·42		− 7·76	
V_a	− 19·99		− 18·61		− 18·24		− 17·01		− 16·09		− 14·33		+ 12·63	
V_d	− ·20		− ·19		− ·18		− ·23		− ·21		− ·22		+ ·13	
Curv.	− ·28		− ·28		− ·28		− ·28		− ·28		− ·28		− ·28	
Radial Velocity	+ 17·6		+ 4·8		+ 15·6		− 0·9		+ 13·5		− 0·4		+ 4·7	

MEASURES OF BOSS 3511—*Concluded*

λ	8462 Vel.	Wt.	8467 Vel.	Wt.	8479 Vel.	Wt.	8486 Vel.	Wt.	8493 Vel.	Wt.	Vel.	Wt.	Vel.	Wt.
4584	−19·8	½					+19·6	½	− 1·7	½				
4572	−25·0	½	+ 6·7	½	− 7·2	1	+16·6	½	+ 8·0	¾				
4563					− 6·0	1								
4549	+ 2·6	1	+ 9·9	1	+ 3·3	1	− 9·5	1	+ 7·9	1				
4528	+13·0	½												
4501	−14·6	½			+ 9·0	½			+18·3	½				
4481	+11·9	1			+26·6	½	+13·5	½	+ 6·7	1				
4468					+ 3·0	½								
4415	+ 6·0	½	+17·8	1	+11·0	1	−11·1	½	+20·6	1				
4404	+ 3·5	½	+ 3·9	1	+ 9·2	1	− 3·5	1	+ 8·7	1				
4395			+22·8	½										
4383					+ 4·7	1								
4351	−13·0	1					+10·0	1						
4340	− 3·5	½	+ 6·4	1					+ 7·8	1				
4325	− 2·8	1	+ 7·2	½			+ 2·0	1	+ 3·1	1				
4307	+ 4·7	½					+16·9	½	+13·8	1				
4294			− 6·3	1	−10·8	½	−22·6	½	+22·4	1				
4290							+ 0·2	½						
4271	+ 2·6	1	+18·1	½	− 0·3	1	− 2·7	1	+19·1	1				
4260					+ 2·6	1	+ 5·0	1	+16·0	1				
4250	+ 0·6	½							+14·3	1				
4236	+11·2	½	+10·0	½					+ 9·2	1				
4233	+11·1	½			+10·1	½	+ 4·2	1	+21·8	1				
4215	+ 2·0	1												
4202			+ 9·1	½										
4198							+ 6·3	½						
4143	+ 4·2	1												
4071	+ 1·5	½							+ 3·8	½				
4063									+ 2·5	1				
4045	+ 0·5	½	+ 5·4	½			−26·1	1	+ 7·0	1				
Weighted mean	− 0·17		+ 8·38		+ 3·47		− 0·08		+ 11·32					
V_a	+ 9·64		+ 6·11		+ 0·89		− 3·22		− 3·97					
V_d	+ ·08		− ·11		+ ·20		+ ·15		+ ·07					
Curv.	− ·28		− ·28		− ·28		− ·28		− ·28					
Radial Velocity	+ 9·3		+ 14·1		+ 4·3		− 3·4		+ 7·1					

The Ottawa observations were grouped according to phase, using the period 1·61100 days, into 9 normal places of equal weight and, after preliminary elements had been obtained graphically, a least-squares solution was carried through to derive corrected values. The preliminary elements adopted were:

$$P = 1·61100 \text{ days}$$
$$e = ·05$$
$$\omega = 195°$$
$$K = 10·5 \text{ km.}$$
$$\gamma = +7·10 \text{ km.}$$
$$T = \text{J.D. } 2,417,018·020$$

The most satisfactory solution was obtained when T, the time of periastron passage, was considered fixed and corrections determined for the remaining four elements, e, ω, K and γ. The period was considered determined from the early observations taken in conjunction with our own.

NORMAL PLACES

	Mean Phase	Mean Velocity	O–C
1	1·130	+ 5·98	− ·71
2	1·344	− 0·02	+ ·81
3	1·521	− 4·20	− ·29
4	·148	− 0·58	−1·05
5	·246	+ 5·70	+1·44
6	·444	+11·10	− ·68
7	·594	+15·35	+ ·04
8	·751	+16·07	− ·09
9	·883	+15·03	+ ·62

Making the substitutions,

$$x = \delta\gamma$$
$$y = \delta K$$
$$z = K \cdot \delta e$$
$$u = K \cdot \delta\omega$$

in the Lehmann-Filhés formula, the following observation equations resulted:

OBSERVATION EQUATIONS FOR BOSS 3511

No.	x	y	z	u	$-n$
1	1·000	+ ·088	+ ·848	− ·978	+2·04 =0
2	1·000	− ·693	+ ·434	− ·751	− ·16 =0
3	1·000	−1·040	− ·869	− ·112	+ ·37 =0
4	1·000	− ·672	− ·018	+ ·794	+ ·62 =0
5	1·000	− ·308	+ ·729	+ ·978	−1·84 =0
6	1·000	+ ·449	+ ·706	+ ·881	+ ·71 =0
7	1·000	+ ·832	− ·322	+ ·487	+ ·48 =0
8	1·000	+ ·950	− ·940	− ·055	+1·00 =0
9	1·000	+ ·812	− ·696	− ·497	+ ·59 =0

NORMAL EQUATIONS

$$9 \cdot 000x + \cdot 418y - \cdot 128z + \cdot 747u + 3 \cdot 810 = 0$$
$$4 \cdot 572y - \cdot 945z + \cdot 060u + 2 \cdot 202 = 0$$
$$4 \cdot 163z + \cdot 504u - 1 \cdot 016 = 0$$
$$4 \cdot 381u - 2 \cdot 902 = 0$$

From these there resulted the small corrections,

$$\delta\gamma = - \cdot 46 \text{ km.}$$
$$\delta K = - \cdot 44 \text{ km.}$$
$$\delta e = + \cdot 004$$
$$\delta\omega = +4° \cdot 05$$

so that the final values of the elements are:

$$P = 1 \cdot 61100 \text{ days}$$
$$e = \cdot 054$$
$$\omega = 199° \cdot 05$$
$$K = 10 \cdot 06 \text{ km.}$$
$$\gamma = +6 \cdot 64 \text{ km.}$$
$$T = \text{J.D. } 2,417,018 \cdot 020$$
$$a \sin i = 222,500 \text{ km.}$$
$$\frac{m_1 \sin^3 i}{(m+m_1)^2} = \cdot 0002 \; \odot$$

Dominion Observatory
      Ottawa
            April, 1918.
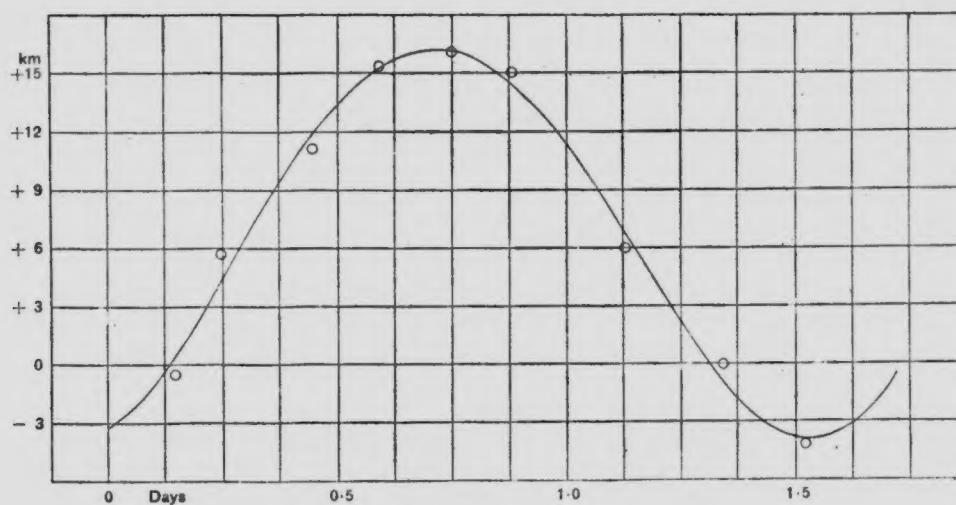
Radial Velocity Curve of Boss 3511